UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/591,391	06/30/2008	Lars Stolt	1505-1100	9580

466 7590 07/27/2011

YOUNG & THOMPSON
209 Madison Street
Suite 500
Alexandria, VA 22314

EXAMINER	
CHEN, KEATH T	

ART UNIT	PAPER NUMBER
1716	

NOTIFICATION DATE	DELIVERY MODE
07/27/2011	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

DocketingDept@young-thompson.com

Office Action Summary	Application No.	Applicant(s)	
	10/591,391	STOLT ET AL.	
	Examiner	Art Unit	
	KEATH CHEN	1716	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _08 June 2011_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _63-74,80-85 and 87-96_ is/are pending in the application.

4a) Of the above claim(s) _63-74,95 and 96_ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _80-85 and 87-94_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

Applicants' amendment to the claim, filed on 06/08/2011, in response to the rejection of claims 80-94 from the non-final office action (02/08/2011), by amending claims 63-74, 80-85, and 87-96 and cancelling claim 86 is acknowledged and will be addressed below.

Election/Restrictions

1. Claims 63-74 and 95-96 remain withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected Species, there being no allowable generic or linking claim.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 80-81, 85, 88, and 91 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (US 5141564, hereafter '564), in view of Regittnig (US 20010022992, hereafter '992).

'564 teaches some limitations of:

Claim 80: in-line system 80 for forming the material (Fig. 3, col. 6, lines 45-46) CIGS thin film (col. 1, line 65, the claimed "in-line continuous substrate flow production apparatus for fabrication of copper indium gallium diselenide (CIGS) solar cells"):

A vacuum chamber 84 (col. 6, line 49, the claimed "a CIGS process chamber") a suitable back metal contact 32 (i.e., conductive metal layer) is deposited on one surface

of the substrate 31. Excellent results are obtained using molybdenum (col. 3, lines 39-41, the claimed “substrates provided with a molybdenum back contact layer continuously move through a deposition zone (DZ) in the CIGS process chamber”),

Adjustable temperature controller 98, 100, 102 and heating coils 99, 101, 104 (col. 6, lines 60-65 and col. 7, lines 9-14, the claimed "the process chamber comprises a plurality of separated substrate heaters”),

simultaneously introduce gallium, copper, indium, and selenium into the chamber from independently heated and controlled (col. 5, lines 4-6, the claimed “evaporation sources with Cu, In, Ga and Se, and source heaters”)

Control of evaporation rates for the various elements is accomplished by a quartz crystal controller for Se and an electron impact emission spectroscopy evaporation rate controller for the Cu, Ga, and In (col. 5, lines 48-51, applicable to in-line system, **see claim 27(b)**, through these sensors a composition gradient is derived, see abstract, the claimed “at least one composition detection device for detecting the respective amounts of deposited **elements** in the CIGS, and a controller connected to said at least <u>one</u> composition detection device<u>, the controller</u> adapted to adjust the evaporant fluxes in the respective rows in response to a detected variation in deposited amount of the corresponding element in order to provide a CIGS layer of uniform composition of elements”, note the control of rate requires a controller, either automatically or manually, see also ‘564’s claim 39 (c)).

‘564 teaches only one row of evaporation source, therefore, does not explicitly teaches the other limitations of:

Claim 80: the sets of evaporation sources provided in rows over the width of a substrate, (at least one composition detection device for detecting the respective amounts of deposited elements in the CIGS) at each of the rows

‘992 is an analogous art in the field of evaporation apparatus, particularly adapted to an evaporation plant for forming thin layers on a substrate (title), particular in solar modules ([0001]). ‘992 teaches plurality of rows of evaporation sources 11 can be placed side by side, in order to vaporize (metallize) the width of the substrate 8 as well as the whole length thereof with one pass ([0021]).

At the time the invention was made, it would have been obvious to a person having ordinary skill in the art to have duplicated the rows of evaporation sources side by side in width direction of the substrate, as taught by ‘992, for the gallium, copper, indium, and selenium sources in Fig. 3 of ‘564, for the purpose of metalize the width of the substrate in one pass, as taught by ‘992 ([0021]). **Note a person of ordinary skill in the art would have known to have duplicated the sensors and control of the additional rows independently for a uniform structure of the layers (‘992, [0037])**.

Claim 81 is rejected for substantially the same reason as discussed above (note ‘564 is to generate uniform grain size, col. 5, lines 53-55).

Fig. 3 of ‘564 shows “the evaporant vapor sources are arranged at a level below the substrates” of claim 85; and quartz crystal is intrinsically capable of measuring total thickness from Se, Cu, Ga, and In, furthermore, the thickness of various layers are claimed in '564, therefore, it would have been obvious to use the quartz crystal to monitor the total thickness, the claimed “a separate thickness measuring device connected to the controller for measuring the **thickness** of the deposited CIGS layer is provided, and the controller is adapted to adjust the fluxes from the evaporant sources to in response to a detected thickness variation in order to provide a CIGS layer of uniform thickness” of claim 91); simultaneously introduce gallium, copper, indium, and selenium into the chamber from **independently** heated and **controlled** (col. 5, lines 4-6, the claimed “the controller is adapted to receive as input signal a signal representative of the total deposited amounts of each element and in response to said latter signal adjust the fluxes from the evaporant sources in order to provide a uniform thickness of the CIGS film” of claim 88).

3. Claim 82 is rejected under 35 U.S.C. 103(a) as being unpatentable over ‘564 and ‘992, further in view of Yamazaki et al. (US 20020139303, hereafter ‘303).

‘564 and ‘992, together, teach all limitations of claim 80, as discussed above. ‘992’s teaching that a plurality of rows of evaporation sources 11 can be placed side by side, in order to vaporize (metallize) the width of the substrate 8 ([0021], the claimed “there are two rows of vapour sources arranged over the width of the process chamber as seen in the transport direction of the substrates, wherein the two rows of evaporation

sources are arranged at each side of along which substrates flow through the deposition chamber" of claim 82.

Both ‘564 and ‘992 are silent on the position of the vapour sources relative to the substrate path, therefore, does not explicitly teach the limitations of:

Claim 82: (the two rows of evaporation sources are arranged at each side of and) outside the path along which substrates flow through the deposition chamber.

‘303 is an analogous art in the field of deposition apparatus (title), particularly using a plurality of evaporation sources (abstract). ‘303 teaches a plurality of rows of evaporation sources 306 ([0092]) outside the substrate transport path ([0095]) as shown in Fig. 3A.

At the time the invention was made, it would have been obvious to a person having ordinary skill in the art to have positioned the evaporation sources outside of substrate transport path, as taught in Fig. 3A of ‘303, to the combined apparatus of ‘564 and ‘992, for its suitability with predictable results. The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. MPEP 2144.07.

4. Claim 83-84 and 90 are rejected under 35 U.S.C. 103(a) as being unpatentable over ‘564 and ‘992, further in view of Nishitani et al. (US 5633033, hereafter ‘033).

‘564 and ‘992, together, teach all limitations of claim 80, as discussed above.

‘564 and ‘992, together, do not teach limitations of:

Claim 83: said at least one composition detection device is provided within the process chamber.

Claim 84: said at least one composition detection device is provided outside the process chamber.

Claim 90: said at least one composition detection device is a resistance measuring device.

‘033 is an analogous art in the field of apparatus for manufacturing solar cell (field of the invention). ‘033 teaches detection … an electric resistance of the thin film layer is increasing with the change in its composition (col. 5, lines 38-40). Note such resistance measurement of thin film required to be in-situ (within the process chamber of claim 83). ‘033 also shows the use of IR reflection to indicate composition (Fig. 5, col. 8, lines 10-19) and the sensor can be inside or outside the chamber (Fig. 3 and 4, respectively).

At the time the invention was made, it would have been obvious to a person having ordinary skill in the art to have added/replaced the composition measurement (for claim 90) with a in-situ resistance measurement of the thin film or with an IR reflection detection within or outside the process chamber (for claims 83 and 84

respectively), as taught by '033, to the combined apparatus of '564 and '992, for its suitability with predictable results. The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. MPEP 2144.07.

5. Claim 87 is rejected under 35 U.S.C. 103(a) as being unpatentable over '564 and '992, further in view of Bachmann et al. (US 4121238, hereafter '238).

'564 and '992, together, teach all limitations of claim 80, as discussed above.

'564 and '992, together, do not teach limitations of:

Claim 87: said at least one composition detection device is an X-ray fluorescence device and/or an EDX (energy dispersion X-ray spectroscopy) device adapted to measure the total deposited amounts of each element and thereby also the thickness of the CIGS layer.

'238 is an analogous art in the field of metal oxide/indium phosphide device (title), including solar cell (abstract). '238 teaches the use of x-ray fluorescence to determine the composition (col. 3, lines 18-43).

At the time the invention was made, it would have been obvious to a person having ordinary skill in the art to have added/replaced the composition measurement with a x-ray fluorescence, as taught by '238, to the combined apparatus of '564 and '992, for its suitability with predictable results. The selection of something based on its

known suitability for its intended use has been held to support a *prima facie* case of obviousness. MPEP 2144.07.

6. Claim 92 is rejected under 35 U.S.C. 103(a) as being unpatentable over '564 and '992, further in view of Kuchinski et al. (US 20050072461, hereafter '461).

'564 and '992, together, teach all limitations of claim 80, as discussed above.

'564 and '992, together, do not teach limitations of:

Claim 92: thickness measuring device is a profilometer.

'461 is an analogous art in the field of coating of CIGS film (abstract). '461 teaches the use of commercial available profilometer to measure the film thickness ([0109]).

At the time the invention was made, it would have been obvious to a person having ordinary skill in the art to have added/replaced a profilometer, as taught by '461, to the combined apparatus of '564 and '992, for its suitability with predictable results. The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. MPEP 2144.07.

7. Claim 93-94 are rejected under 35 U.S.C. 103(a) as being unpatentable over '564 and '992, further in view of Beck et al. (US 20020106873, hereafter '873).

‘564 and ‘992, together, teach all limitations of claim 80, as discussed above. ‘564 teaches Cu, In, Ga sequence in Fig. 3 (the claimed “there are evaporant sources with Cu, Ga and In”).

‘564 and ‘992, together, do not teach limitations of:

Claim 93: the evaporant sources are arranged in the following order as seen in the transport direction of a substrate: Ga, Cu, In.

‘873 is an analogous art in the field of fabricating solar cell ([0036]) a CIGS film ([0052]). ‘791 teaches type (k) (In--Se /Ga--Se/Cu--Se/In--Se) ([0101]).

At the time the invention was made, it would have been obvious to a person having ordinary skill in the art to have re-arranged the order of evaporant sources as Ga, Cu, In, as taught by ‘873, to the combined apparatus of ‘564 and ‘992, for the purpose of generate type k solar cell.

‘564 further teaches a Gallium source in the downstream process area 90 for doping the CdZnS layer (col. 7, lines 6-8, therefore, it is after chamber 89 in Fig. 3, the claimed “a further evaporation source with Ga arranged downstream the In evaporation source” of claim 94).

8. Claim 89 is rejected under 35 U.S.C. 103(a) as being unpatentable over ‘564 and ‘992, further in view of Lu (US 5880823, hereafter ‘823).

‘564 and ‘992, together, teach all limitations of claim 80, as discussed above. “564 is silent on calibration of sensors.

‘564 and ‘992, together, do not teach limitations of:

Claim 89: composition detection device is a device that measures the composition of the CIGS layer indirectly by calibrating against a physical parameter to obtain a measure of an amount of Cu, Ga, and In.

‘823 is an analogous art in the field of measuring atomic vapor density in deposition systems (title). ‘823 teaches that Electron Impact Emission Spectroscopy has long term stability and operation pressure range (col. 1, lines 20-24) and similarly atomic absorption Spectroscopy having a baseline instability problem (col. 1, line 42 and lines 58-61). ‘823 provides a solution by using dual-source dual-beam optical configuration (Fig. 2, col. 3, lines 62-63) and cites an example using Cu emission lines for calibration (col. 4, line 66 to col. 5, line 2, the claimed “indirectly by calibrating against a physical parameter to obtain a measure of an amount of Cu”).

At the time the invention was made, it would have been obvious to a person having ordinary skill in the art to have used the dual-source dual-beam optical calibration based on Cu emission lines, as taught by '823, to the Electron Impact Emission Spectroscopy of ‘564, for the purpose of correcting the long term stability problem of Electron Impact Emission Spectroscopy, as taught by ‘823 (col. 1, lines 20-

24). Note a person of ordinary skill in the art would also know to have calibrated using Ga and In, respectively, for the Cu and In sources.

Response to Arguments

Applicant's arguments filed 06/08/2011 have been fully considered but they are not persuasive.

9. In regarding to 35 USC 112 2nd paragraph rejection of claims 86 and 89, see the bottom of page 11 to the top of page 12, Applicants' amendment of claim 89 and cancellation of claim 86 overcome the rejection.

10. In regarding to 35 USC 103(a) rejection of claims 80-81, 85-86, 88-89, and 91, Applicants argue that

A) Chen '564 oscillating quartz crystal and electron impact emission spectroscopy are measuring flux of vapor at the sources, while the determination (of instant Application) also determined by the probability that the species that reach the surface of the growing layer, see the 2nd to the 5th paragraph of page 13.

This argument is found not persuasive.

Applicants are arguing that the measurement is made on the deposited film directly as in the claim limitation "at least one composition detection device for detecting the respective amounts of **deposited** elements in the CIGS". This argument is inconsistent with the limitation of claim 89 "measure the composition of the CIGS layer indirectly".

Nevertheless, the examiner disagree the claim limitation refers to direct measurement of **deposited** element. Rather, the claim is read as “at least one composition detection device for detecting the respective amounts of deposited **elements** in the CIGS” and the deposited elements are Se, Cu, Ga, and In, which are measured by oscillating quartz crystal and electron impact emission spectroscopy respectively.

Furthermore, the use of XRF for direct measurement is taught by ‘238 as discussed in claim 87 rejection above.

B) The flux sensor has higher uncertainty and may be different than that on the surface of the growing layer, see the bridging paragraph between pages 13-14.

This argument is found not persuasive.

The examiner maintains the accuracy of different detection methods is not part of claim limitation.

Furthermore, the use of XRF for direct measurement is taught by ‘238 as discussed in claim 87 rejection above, which would have the same accuracy as Applicants’ claim.

C) Claim 80 requires detection devices for detecting the <u>respective amounts</u> of deposited elements in the CIGS, see the first complete paragraph of page 14.

This argument is found not persuasive.

The examiner maintains that the deposited elements are Se, Cu, Ga, and In, which are measured by oscillating quartz crystal and electron impact emission spectroscopy respectively, therefore, <u>respective amounts</u> are detected.

D) ‘564 discussion of evaporation rate in conjunction with a batch deposition reactor, but did not discussed the control in in-line system of Fig. 3, see the last two paragraphs of page 14.

This argument is found not persuasive.

Claim 27 item (b) of ‘564, applicable to both batch system and in-line system, requires control deposition rate of each element.

Furthermore, a person of ordinary skill would have understood the need to control deposition in both batch and in in-line system.

E) The combination of ‘564 with Regittnig ‘992 by introducing a plurality of rows, the resulting combination would not teach a controller adapted to adjust the evaporant fluxes in respective rows, see the third paragraph of page 15.

This argument is found not persuasive.

The examiner maintains that a person of ordinary skill in the art would have known to have duplicated the sensors and control of the additional rows independently for the purpose of a uniform structure of the layers (‘992, [0037]).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KEATH CHEN whose telephone number is (571)270-1870. The examiner can normally be reached on 6:30AM-3 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KEATH T CHEN/
Primary Examiner, Art Unit 1716